RESEARCH ARTICLE

The Role of *Saccharomyces boulardii* as a Probiotic in Mice with Celiac Disease

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ABSTRACT

Saccharomyces boulardii is used as a probiotic with the purpose of introducing beneficial microbes into the intestines and protection against pathogens. The goal of this study is to see if it can prevent mice from celiac disease. 20 mice were divided into four groups as follows: control, disease (1.5 mg/g gliadin oral), co-treatment (*S. boulardii* 10^6 cfu/kg oral after gliadin gavage) and *S. boulardii* 10^6 cfu/kg groups. Tissue transglutaminase IgA (tTg-IgA), pepsin, amylase, vitamin D3 was measure by enzyme-linked immunosorbent assay (ELISA). Analytical statistics The data were compared using ANOVA. Results shown the tTG-IgA was increase in the group disease but was decrease in co-treatment (*S. boulardii* 10^6 cfu/kg oral after gliadin gavage) and *S. boulardii* 10^6 cfu/kg groups. Pepsin and vitamin D3 had decreased in group disease, However, in the co-treatment group, things returned to normal. Amylase levels in the disease group were greater than in the control group, Between the co-treatment and control groups, there was a decrease. We found that giving *S. boulardii* to those with celiac disease improved their biochemical, which was more noticeable after they were exposed to gliadin**.**

Keywords: Biochemical, Celiac disease, Gliadin, Mice, *Saccharomyces boulardii*.

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INTRODUCTION

Celiac disease, also known as gluten-sensitive enteropathy, is a small intestinal inflammatory ailment that causes persistent diarrhea, tiredness, weight loss, steatorrhea, and growth failure.[1-3] This typically results in a reduction in food, vitamin, and mineral absorption, as well as an increased risk of anemia, infertility, osteoporosis, otherwise uncommon small intestine malignancies, and a variety of autoimmune illnesses.[4,5]

Gluten, a water-insoluble protein complex of wheat, barley, and rye made of gliadin and glutenin, which is resistant to digestion in the human gastrointestinal tract, triggers an inflammatory response in genetically predisposed individuals.[6,7] The small intestine's submucosa is crossed by big peptide fragments of partially digested gliadin. They bind to HLA-DQ2 or DQ8 on antigen presenting cells (APCs) and are delivered to T cells in the lamina propria after being modified by tissue transglutaminase (tTG), stimulating both the adaptive and innate immune responses. Enzymes are proteins that are prone to proteolytic destruction in the gastrointestinal tract's harsh environment, which is rich in proteolytic enzymes, including pepsin, trypsin, and chymotrypsin.[7,8]

Saccharomyces boulardii is a yeast strain that was originally isolated from mangosteen and lychee fruit. *S. boulardii* remain within the gastrointestinal lumen after eating, protecting and retumed the normal bacteria in the intestine. There are multiple randomized trials that show the efficacy of *S. boulardii* enzymes in the treatment and prevention of numerous gastrointestinal disorders. Studies also reveal that *S. boulardii* enzymes may digest-gliadin and associated compounds.

The effect of probiotics on a gluten sensitivity model in mice was investigated, and it was discovered that the *S. boulardii* strain hydrolyzed the toxic of gliadin peptides, and that its consumption was followed by improved enteropathy, a decrease in histological damage, and pro-inflammatory cytokine production.[9-12] This study aims that the *S. boulardii* as probiotic prevented a Celiac disease.

MATERIALS AND METHODS

Solutions

Gliadin: A 10% solution of gliadin (Sigma) was made by diluting it in 0.02 M acetic acid. Gavage was used to deliver the prepared solution orally (1.5 mg/g body weight).[13]

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S. boulardii: is yeast probiotic capsule product BIOTIC company-USA contain 1×10^3 cells live yeast, was dissolved in sterile water, and orally (1×10^6 cfu/kg body weight) administered.

Animals: For celiac disease induction, 21-day-old mice were used. Animals were kept in a temperature-controlled environment with a 12:12 light/dark cycle and free access to normal laboratory food and water.

Experimental Design

The mice were divided into four groups (N=5) at random: Group one control group: mice were given an oral solution of 0.02 M acetic acid for period 10 days, Group two disease: At 10 days, mice were given oral gliadin (1.5 mg/g). Group three co-treatment: mice received oral gliadin (1.5 mg/g) plus *S. boulardii* (1×10^6 cfu/kg body weight) at 10 day, Group 4 Treatment: mice received oral *S. boulardii* (1×10^6 cfu/kg body weight) at 10 day.

After end of experimental, animals were weighed and anesthetized by chloroform, were bled by Jugular vein, the blood place in separator tubes without EDTA. Serum concentration of tTG-IgA, pepsin, amylase, vitamin D3 were determined using a ELISA according to the manufacturer¢s recommended procedure.[14-17]

Analytical Statistics

The ANOVA analysis was used to assess the data in this study, and significant differences were evaluated using Duncan's multiple-range test, with a significance threshold based on the degree of probability ($p < 0.05$).[18]

RESULTS AND DISCUSSION

The results in Figure 1 showed that the induce of celiac disease led to a increase of significant at the probability level ($p < 0.05$) in the concentration of tTG-IgA level in serum of infected mice compared with the control group.

There were no significant differences in groups of animals treated with compared to the control group, according to the findings.

One study showed that one patient (2%) had strongly positive IgA anti-TtG and antiendomysial antibodies.[19] According to some accounts, certain neurological problems respond to a gluten-free diet, particularly if it is started within the first few months of their onset.[20]

Specific endomysial antibodies, anti-tissue transglutaminase antibodies (a-tTG), and/or deamidated antigliadin antibodies are all very predictive of celiac disease. Antigen-presenting cells transfer gliadin peptides resistant to gastrointestinal enzymes into the small intestine submucosa, where they are presented to T cells by antigen-presenting cells. T cells release IFN- when activated, which drives the adaptive immune response and causes mucosal atrophy.[21]

The *S. boulardii* digested the gliadin harmful peptides, and its ingestion was followed by better enteropathy, a decrease in histological damage, and the production of pro-inflammatory IgA.[10]

Figure 2 shows that the concentration of pepsin in the serum of mice infected with celiac disease was significantly lower ($p < 0.05$) than in the control group.

When compared to the control group, there were no significant differences in groups of treated animals (co-treatment, *S. boulardii*). Enzymes are proteins that are prone to proteolytic destruction in the gastrointestinal tract's harsh environment, which is rich in proteolytic enzymes, including pepsin, trypsin, and chymotrypsin.[22] Pepsin is a digestive enzyme produced by the stomach, and it is most active in acidic surroundings. This means that commercially available enzymes will not provide adequate protection against gluten exposure to alleviate celiac disease symptoms.

Figure 3 shows the results of the current investigation, which revealed a substantial ($p < 0.05$) increase in amylase content in the serum of mice infected with celiac disease when compared to the control group.

While there were decrease significant in animal groups co-treatment and *S. boulardii* compared with celiac disease group.

The cause of increase amylase may be attributed to pancreatic insufficiency in patients with celiac disease, and a relationship was observed between celiac disease and

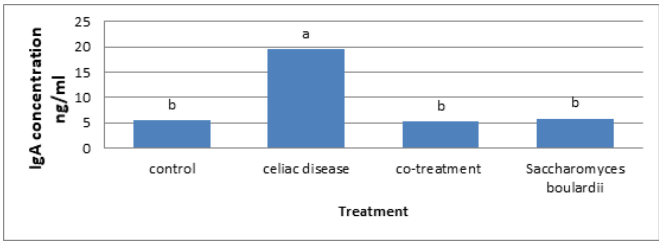

Figure 1: tTG (IgA) level in experimental groups
*Different letters above each column mean that there is a significant difference at the level of significance ($p < 0.05$).

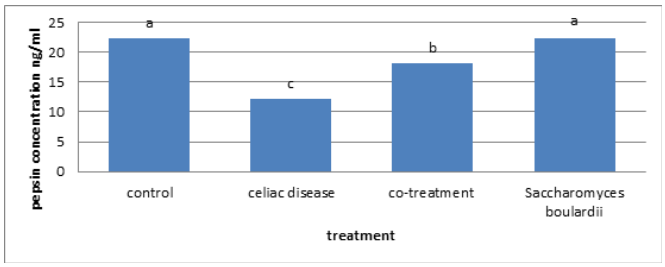

Figure 2: Pepsin level in experimental groups
*Different letters above each column mean that there is a significant difference at the level of significance ($p < 0.05$).

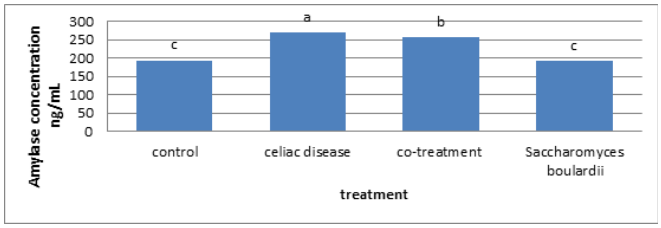

Figure 3: Amylase level in experimental groups
*Different letters above each column mean that there is a significant difference at the level of significance ($p < 0.05$).

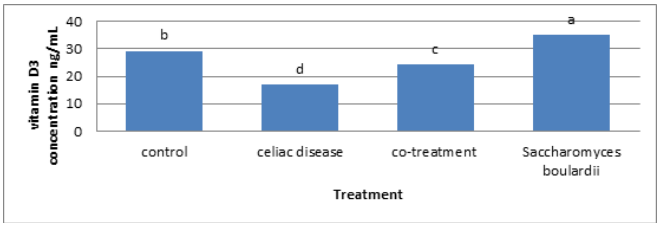

Figure 4: Vitamin D3 level in experimental groups
*Different letters above each column mean that there is a significant difference at the level of significance ($p < 0.05$).

pancreatitis, as celiac disease is more likely to develop chronic pancreatitis than the general population.[23]

Figure 4 shows the findings of the statistical analysis, which revealed that the level of vitamin D3 in the serum of mice with celiac disease was significantly lower ($p < 0.05$) than in the control group.

Also there was increase significant in groups co-treatment and *S. boulardii* compared with celiac group. Because nutritional deficiencies are common in gastrointestinal disease, the decrease in vitamin D3 in celiac disease could be attributed to malabsorption.[24]

The recent studies demonstrate that probiotic treatment could increase vitamin D expression in the host. Jones et al reported that oral supplementation increases levels of D3. Although it has long been recognized that the gastrointestinal tract plays a key role in vitamin D absorption, these findings showed an orally delivered *S. boulardii* as a probiotic improves vitamin D level.[25]

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